

Embedded in 2010: **An End to the Entropy?**

Matt Asay
COO, Canonical



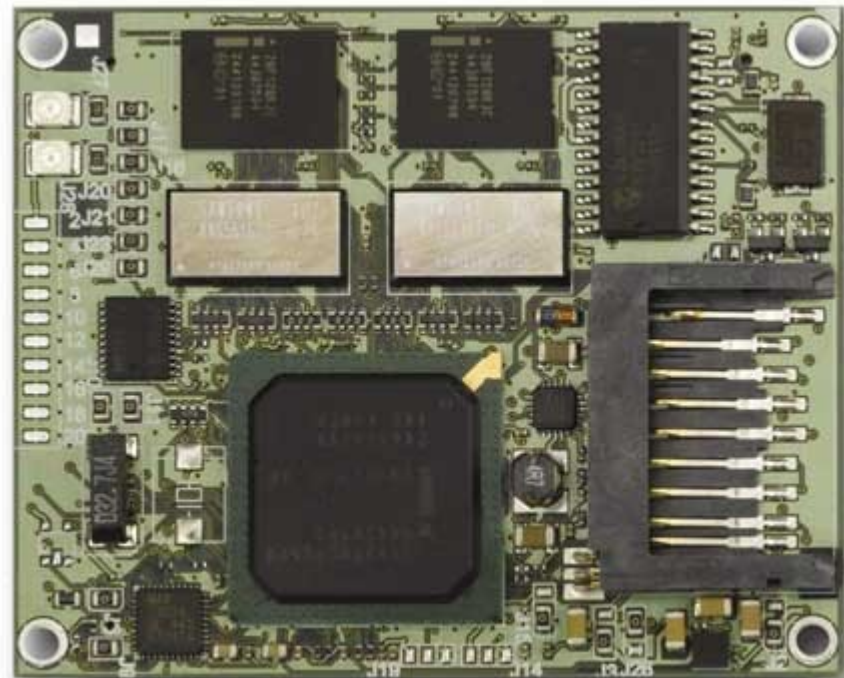
...and where “smart” meets bankruptcy

Remember these?

Board Support Package (BSP)

... The BSP contains routines for initializing and controlling the hardware.
... The primary responsibilities of the BSP are:

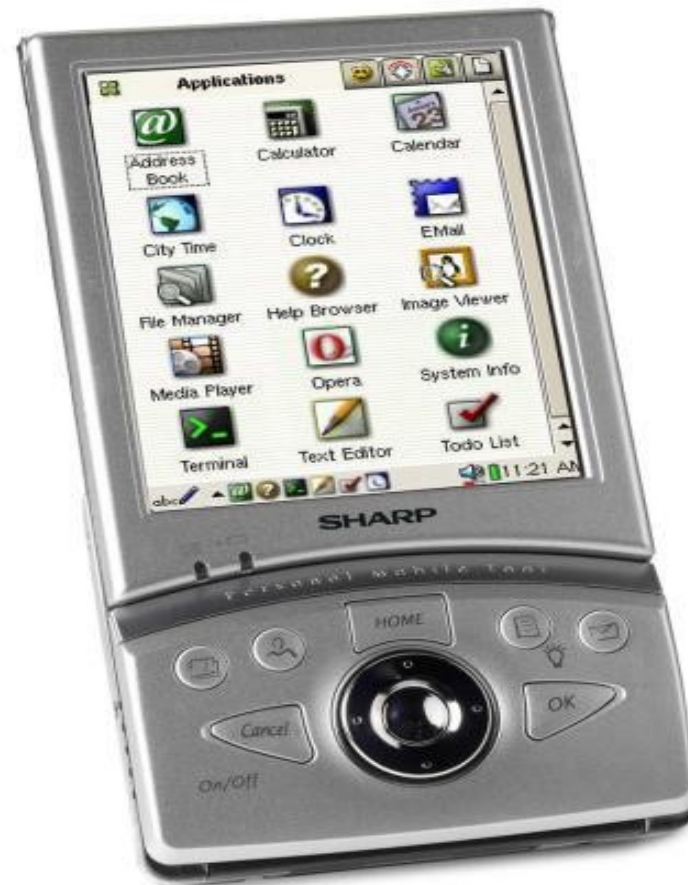
- Interface with boot and shutdown software
- Establish virtual address map for onboard I/O
- Interface with the interrupt controller
- Provide default handlers for error-signaling interrupts
- Interface with the PCI controller
- Interface with the system time (tick timer)



The Past

- ARMv1 – ARMv3
 - Obsolete: **Not powerful enough to run Linux.**
- ARMv4
 - Some very limited Linux BSP's and some level of support in Debian without X. Heavily used in the embedded space with RTOS's
- ARMv5-ARMv6
 - Powerful enough for phones and some smart phones. Limited Linux, and other RTOS's used.

As we grew up...



Today

ARMv7 + Intel Atom + ...

- Powerful enough for smart phones and general-purpose computing, desktop, note/netbooks, and low-power servers



- Need a well-supported general-purpose operating system to support use cases

In summary: BSPs are just the beginning now

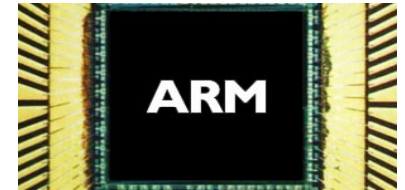
Basic SoC enablement is no longer good enough

- Low-power chips required bare metal to get enough power to run a few apps
- Increasingly powerful chips mean OEMs/ ODMs want general purpose OSes

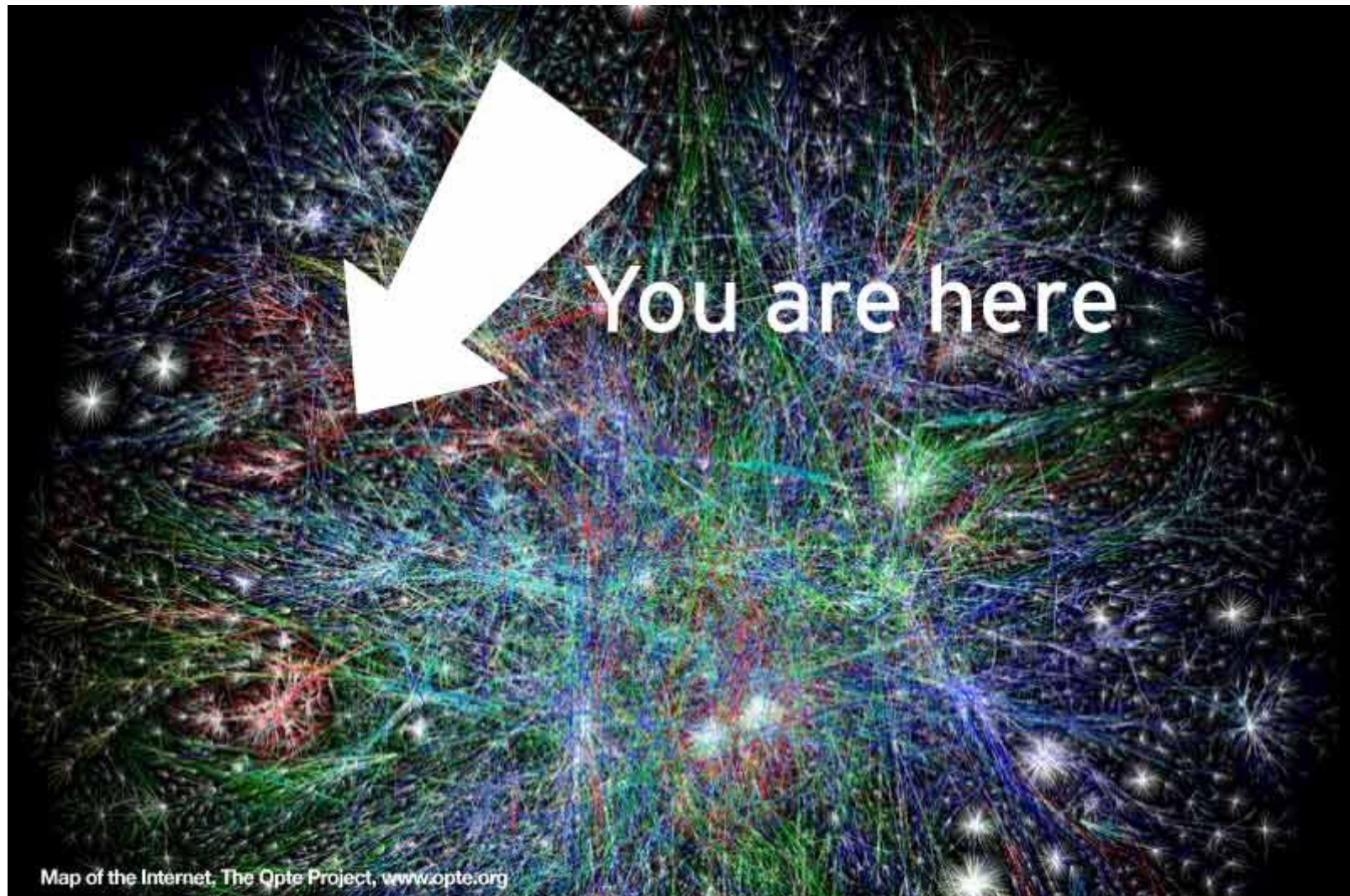


The race is on to create and fill app stores, not merely a PIM suite

- From a handful to dozens to hundreds to thousands to...(?) of apps
- But is there something bigger than an app store?



Yes. It's called "The Internet"



Don't be confused by device proliferation



Why so much device divergence?

- Cheaper to build
 - Lower cost of success... and failure
- Huge pay-out for getting it right
 - iPhone, RAZR, Blackberry Pearl, etc.



This money leads to...

Lots of exploration...

- “Embedded” looks more and more like a general-purpose device OS tied to an even more general-purpose cloud OS

Complete guesswork...

- 50%+ of under-15s will use touchscreen PCs by 2015 (Gartner)

And breathless exaggeration

[Home](#) » [CBS Evening News](#)

April 2, 2010

How the iPad May Change Computers Forever

Cloud + Device = Gold Mine



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Single-purpose gadgets ->

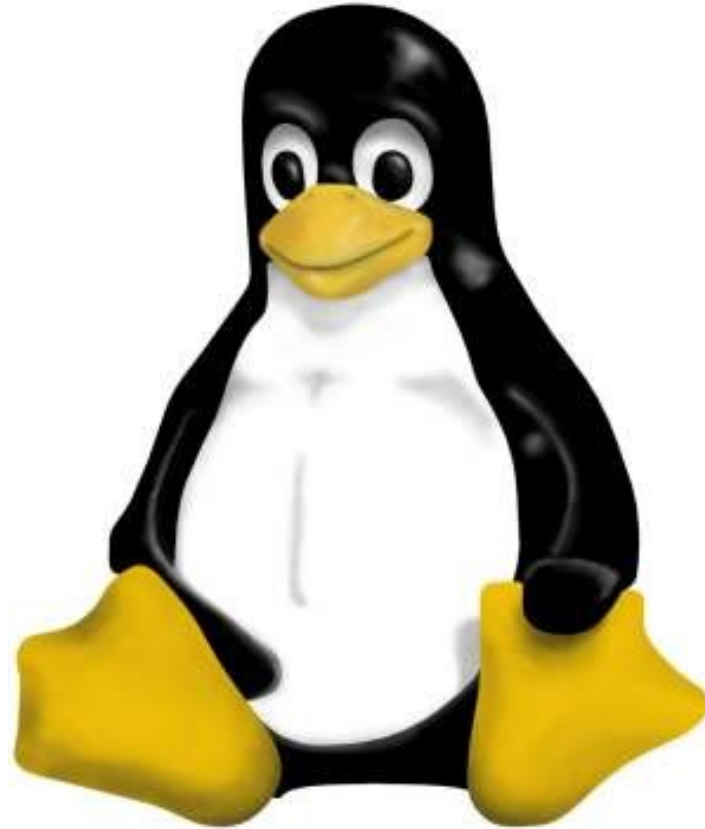
Single-purpose apps w/
general-purpose OS ->

General-purpose cloud
running Linux

OS increasingly common between different form factors



Linux increasingly the common platform



VxWorks

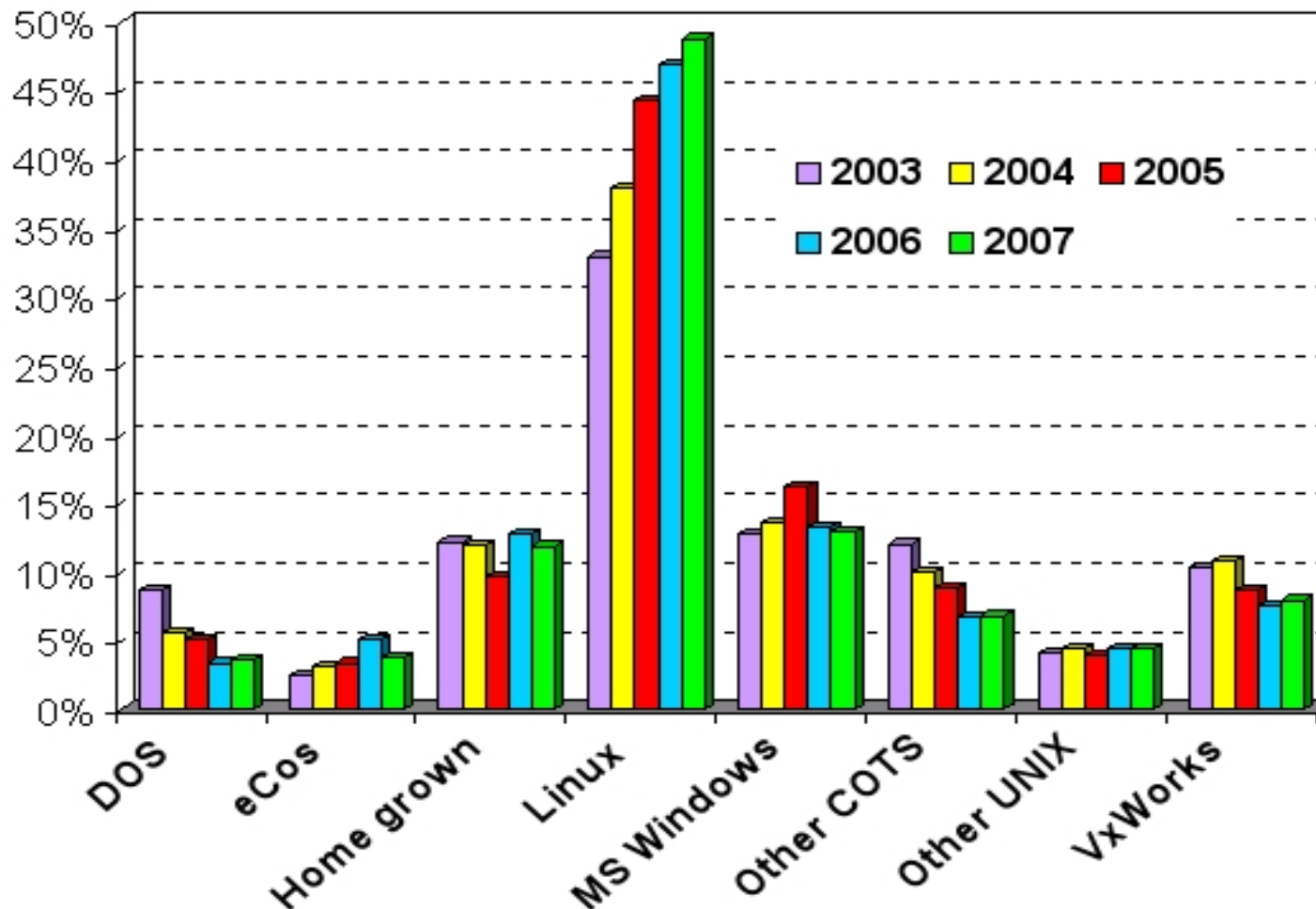
QNX

Microsoft
Windows CE

NUCLEUS

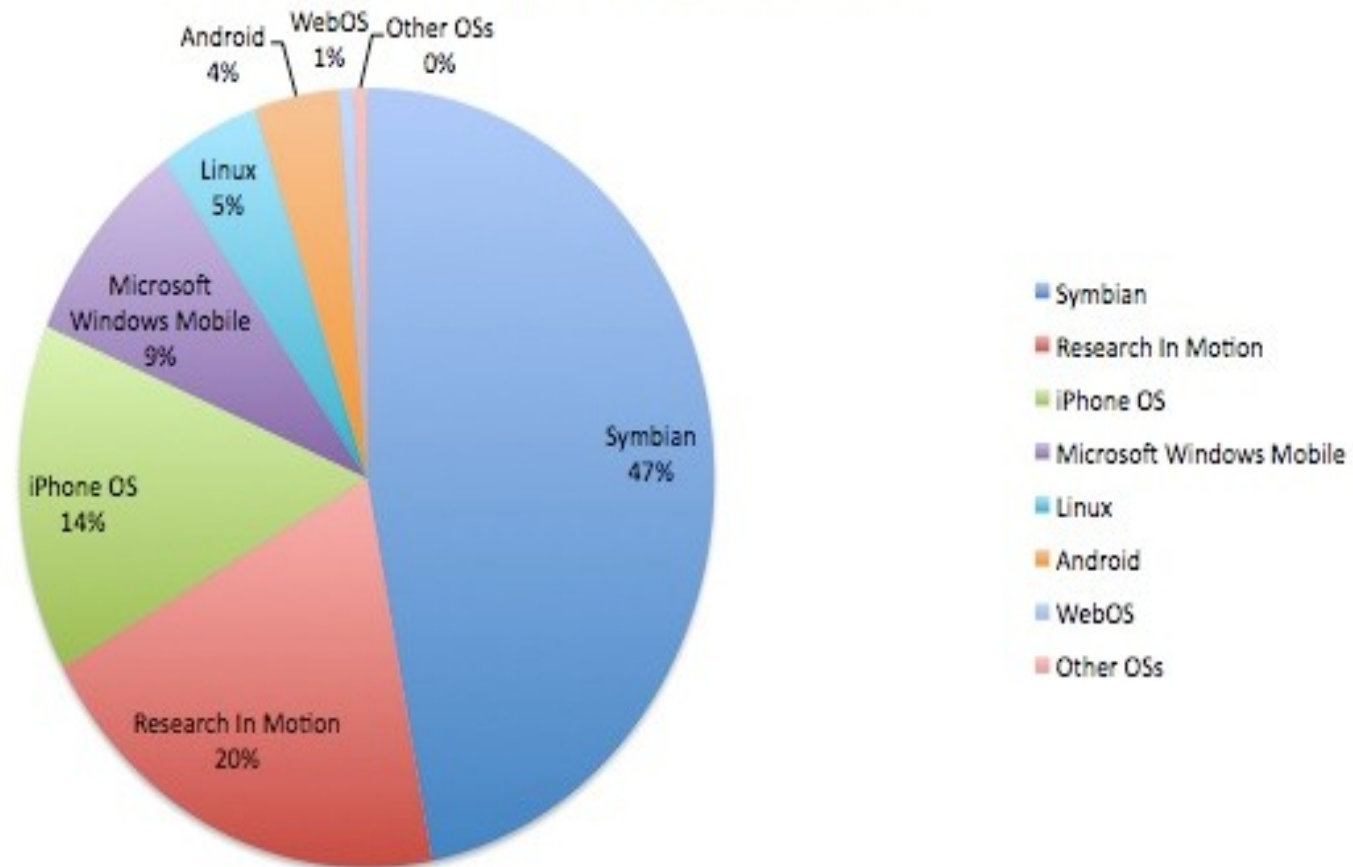
Long ago Linux won the embedded market

Embedded OS sourcing trends



Mobile market next?

Mobile OS 2009 market share Gartner)



Why Linux?

- Device+Services platforms is expensive. Linux can help
 - Lowers the cost of building/maintaining platforms
 - Built-in development community
 - Enables pooled effort to innovate the platform
 - Embrace and extend existing platforms
- New center of real mobile innovation, from RT to memory management to graphics performance
- Allows solution providers to focus on added value (UI, services integration, etc.)

That's how Linux **should** be...but not how it is

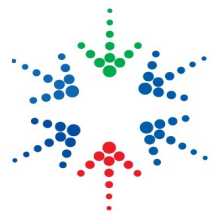


maemo.ORG

MeeGo™



Chrome OS



LiMo

montavista™

Wind River Linux



ubuntu

palm webOS™

bada



ANDROID

Linux **can** be the answer

- App developers want to build and sell new apps; OEMs want to create and sell new SKUs
 - Both can be done with Linux. But we must not go down closed code lines
- Android, e.g., makes life easier for app developers but harder for OEMs (i.e., can't differentiate) – same old Windows problem

Google Draws Criticism for Android Changes

By Carmen Nobel   03/18/10 - 11:02 AM EDT

2 Comments | Add Cor

...but not this way

- Android is a closed, quasi-Linux community
 - Google code line ~8 months ahead of public SDK, with certification/code review by Google
 - Hurts device ODMs/OEMs who must invest in Android, not Linux, skills + QA
 - Speed at expense of the upstream community

"...due to time and resource constraints on [Google's] side, and an inability on our side to make changes that would require core Android system changes, nothing ever got accomplished."
Greg Kroah-Hartman

"You can't ship a nice phone without customizing the kernel to the hardware, and these changes are what makes the code for a platform divert from the mainline tree."

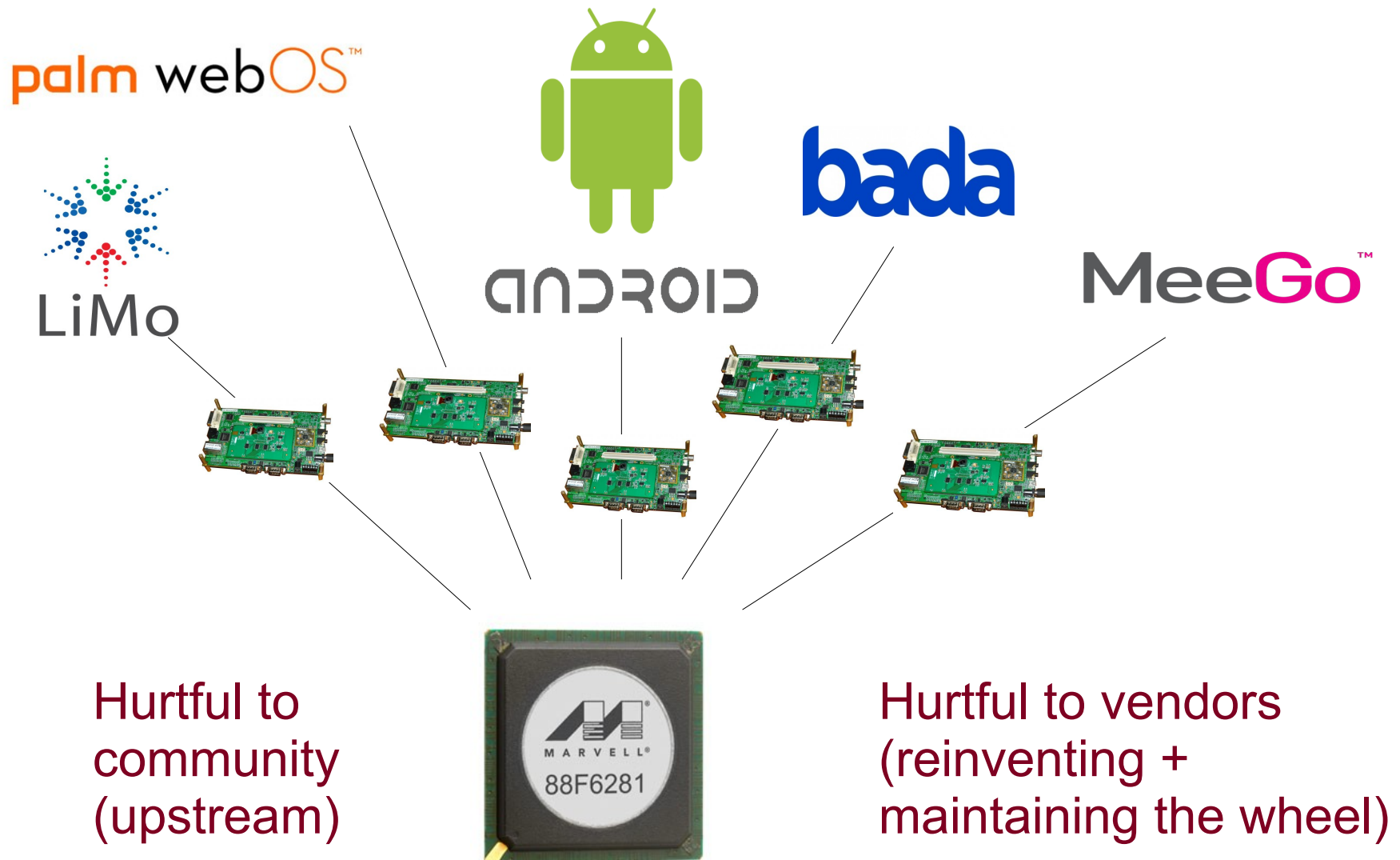
Chris DiBona

Can we converge on an open-source, open-process Linux?

Linux is Linux is Linux...right?

**So why aren't we better coordinating
upstream efforts with enablement?**

A BSP for every user environment is crazy talk



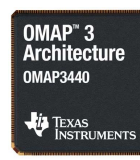


“They make a desert and call it peace.”

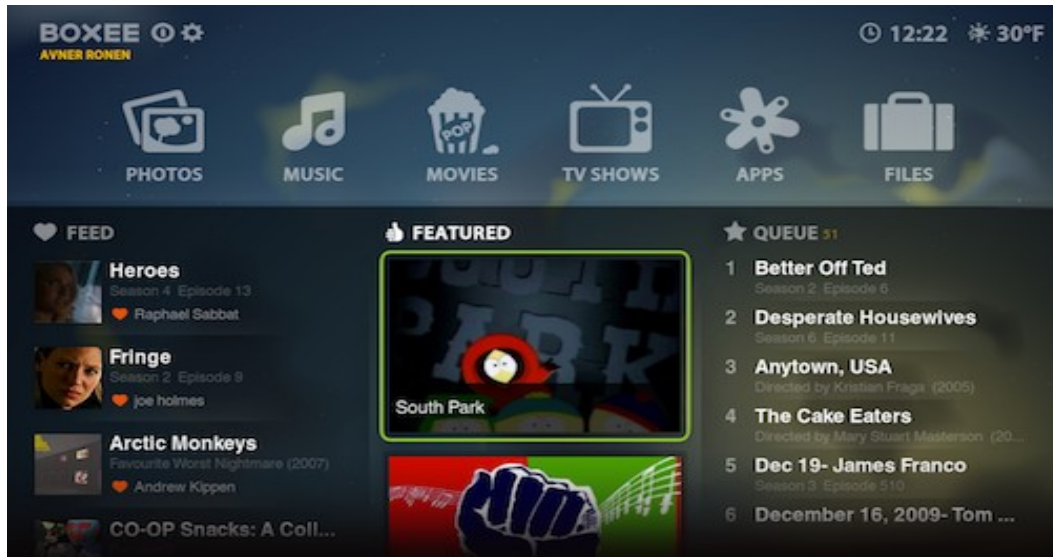
- Tacitus

Wouldn't Linux mobile look better like this?

User Environments



D-Link Boxee – An example of the possibilities



- D-Link Boxee Media Player, *Won multiple 'Best of CES 2010' awards*
 - Nvidia Tegra 2 (ARM Cortex A9)
 - Built on **Ubuntu Core**
- Great example of **accelerated product development** because both SiP and ISV were already using Ubuntu Core
- Don't get me wrong: Canonical has work to do (UDS focus on power, optimization, device tree, etc.)
 - But the idea is to build on a common Linux and focus customization “up the stack”



“Everything that rises must converge.”

Flannery O'Connor (via Pierre Teilhard De Chardin)